Exploiting Hierarchical Locality using PGAS Languages for Productive Extreme Computing

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Abstract

Modern high-performance computers are characterized with massive hardware parallelism and deep hierarchies. Hierarchical levels may include cores, dies, chips, and nodes to name a few. Locality exploitation at all levels of the hierarchy is a must as the cost of data transfers can be high. Programmer's knowledge and the expressivity of locality-aware programming models such as the Partitioned Global Address Space (PGAS) can be very useful. However, locality awareness can come at a high cost. In addition, asking programmers to worry about expressing locality relations at multiple architecture hierarchy levels is detrimental to productivity and systems and hardware must provide adequate support for exploiting hierarchical locality.

In this talk I will discuss a framework for understanding and exploiting hierarchical locality in preparation for the next era of extreme computing. The role of system and hardware support will be highlighted will be stressed and examples will be shared.

Bio

Tarek El-Ghazawi is a Professor in the Department of Electrical and Computer Engineering at The George Washington University, where he leads the university-wide Strategic Academic Program in High-Performance Computing. His research interests include high-performance computing, computer architecture, reconfigurable computing and parallel programming.

He is the founding director of The GW Institute for Massively Parallel Applications and Computing Technologies (IMPACT) and a founding Co-Director of the NSF Industry/University Center for High-Performance Reconfigurable Computing (CHREC). He is one of the principal co-authors of the UPC parallel programming language and the primary author of the UPC book from John Wiley and Sons. He has received his Ph.D. degree in Electrical and Computer Engineering from New Mexico State University in 1988. El-Ghazawi has published well over 250 refereed research publications in this area. Dr. El-Ghazawi has served in many editorial roles including an Associate Editor for the IEEE Transactions on Computers. He chaired and co-chaired many international conferences and symposia. He has served on many advisory boards and in consulting roles including service as a consultant at NASA GSFC and NASA Ames. Dr. El-Ghazawi's research has been frequently supported by Federal agencies and industry including DARPA/DoD, NSF, DoE/LBNL, AFRL, NASA, IBM, HP, Intel, AMD, SGI, and Microsoft. El-Ghazawi is a Fellow of the IEEE, a Research Faculty Fellow of the IBM Center for Advanced Studies, Toronto; a recipient of the Alexander von Humboldt Research Award; and a recipient of the Alexander Schwarzkopf Prize for Technical Innovation and the GW SEAS Distinguished Researcher Award. He also served as a U.S. Senior Fulbright Scholar.